Lead dodecanoate coating for the corrosion inhibition of lead heritage objects: a comparison between aqueous and ethanolic coating media

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Abstract

Lead metal has been used in many applications in ancient times because of its high density and ease of casting due to its low melting point. Some of these applications are for water piping, statues, roofing, weights, coins, and pipe organs. Many of those objects are exposed to atmospheric conditions and are shown in open museum showcases, where it is difficult to be in full control of the environment [1]. Therefore, they corrode and are naturally covered by corrosion products. The most common corrosion products found on lead metal surfaces are litharge (PbO), anglesite ($PbSO_4$), and hydroxycarbonate compounds—such as cerussite ($PbCO_3$), hydrocerussite ($Pb_3(CO_3)_2(OH)_2$), or plumbonacrite ($Pb_{10}(CO_3)_6O(OH)_6$). However, those corrosion products do not cover the surface sufficiently to protect the lead metal [2,3]. One way to avoid or, at least, delay the corrosion is by using protective coatings.

In this work we use aqueous and ethanolic dodecanoate solutions to synthesize a hydrophobic lead dodecanoate coating ($Pb(C_{12})_2$) . This coating works as a barrier preventing access of corrosive substances to the lead metal surface. The coating is made by immersing a set of lead substrates, separately in aqueous sodium dodecanoate solutions. Another set of lead substrates have been coated by immersing them in ethanolic solutions of the dodecanoic acid. The coating formation has been confirmed using FTIR spectroscopy and SEM techniques. The protective properties of the coatings have been studied in an ASTM D1384-87 solution by the use of linear sweep voltammetry (LSV) and electrochemical impedance spectroscopy (EIS). The coatings provided from the aqueous solutions demonstrate better protective properties against lead corrosion comparing to that obtained from the ethanolic solutions.

Keywords: lead, coating, lead preservation, corrosion, lead dodecanoate

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Literature:

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